

**REPORT ON DETECTION OF BENZENE
IN THE OHIO RIVER
RESULTING FROM DISCHARGES OF BENZENE
FROM U.S. STEEL, CLAIRTON WORKS
ON DECEMBER 28-29, 1985**



An upset at U.S. Steel Clairton Works' bio plant caused a discharge of benzene to Peters Creek, at its confluence with the Monongahela River 19.7 miles from the Ohio River, on December 28 and 29, 1985. While the exact amount discharged is unknown, an in-stream sample collected on December 28 at the mouth of Peters Creek indicated a level of 86.6 ug/l. Further sampling of the Monongahela River that same day, three miles downstream of U.S. Steel (Irvin Works intake), indicated a concentration of benzene of 14.6 ug/l.

Subsequent to the December 28-29 spill, benzene was detected above background levels at the Cincinnati Water Works ODS site (mile point 463) over the period January 19-26, 1986. The station located at Wheeling (mile point 86.8) was out of service until January 14th. Both the Huntington, West Virginia (mile point 306.9) and West View Water Authority (mile point 4.5) stations were online in January. No detections of benzene were reported by any of these stations.

The detection at Cincinnati received considerable attention in the local media with newspaper accounts immediately after the January 9, 1986 Commission meeting. In addition, a televised article on the spill appeared on the approximated day the spill was to arrive, some three weeks later. While the Cincinnati ODS site detected above background levels of benzene at that time, it is uncertain as to the extent the presence of benzene can be attributed to discharges from U.S. Steel.

In an effort to further clarify the relationship of benzene in the Ohio River as detected by the Commission's Organics Detection System, to the U.S. Steel spill of December 28-29, 1985, a review of operational performance of the ODS during the spill event has been undertaken. Specifically, for each of the Commission's ODS stations extending downstream from the spill site to Cincinnati (stations located at West View, Wheeling, Huntington, and Cincinnati), the following determinations were made:

1. Calculated date of arrival of the benzene spill given time-of-travel formulas developed by Commission river modeling studies and measured flow in the Ohio River.
2. Operational performance summaries of the station as related to the detection of benzene before, on and after the calculated date of arrival of the spill.
3. Potential point sources of benzene discharges to the river in addition to U.S. Steel.

Detection at West View Water Authority
(Ohio River mile 4.5)

The West View Water Authority is the first Organics Detection System (ODS) station on the Ohio River downstream from the U.S. Steel, Clairton Works (approximately 25 miles downstream). A

review of available river flow data indicates that the Monongahela River had a flow of 93,000 cubic feet per second on December 29, 1985, and 85,000 cubic feet per second on December 30, 1985. This corresponds to a velocity of 0.63 miles per hour and 0.58 miles per hour, respectively. With these velocities a discharge from U.S. Steel on the 29th of December would arrive at West View approximately 40 hours later, either the 30th or 31st of December.

The results of benzene sampling at West View Water Authority for the period December 24, 1985 through January 1986 indicated no concentrations above the minimum detection level of 0.1 ug/l.

Detection at Wheeling, West Virginia
(Ohio River mile 86.8)

The Wheeling, West Virginia ODS station was not operational over the period from December 24, 1985 to January 14, 1986 and from January 18 to January 21, 1986. According to the time of travel calculation shown on Attachment 1, the spill was calculated to arrive at Wheeling on January 5th. Therefore, this station was not operational at the time the spill may have arrived.

Detection at Huntington, West Virginia
(Ohio River mile 306.9)

Calculations (Attachment 1) indicate that the benzene spill could be expected to arrive at the Huntington, West Virginia ODS station on or about January 18, 1986. The Huntington ODS station was not operational over the period from January 1, 1986 to

January 19, 1986; however, samples were being collected daily and preserved. When the system was returned to operation (January 19) the preserved samples were analyzed. No detections of benzene were recorded for January 1986.

Detection at Cincinnati, Ohio
(Ohio River mile 462)

The time of travel from U.S. Steel, Clairton to the Cincinnati Water Works ODS station was calculated to be approximately 25 days, resulting in estimated arrival at Cincinnati on or about January 23, 1986. It should be noted that this estimate is particularly speculative because there were no intermediate points of detection which allows correction of error. Attachment 2 lists the result of sampling for benzene for January 1 to January 31, 1986. Cincinnati detected benzene at levels ranging from 0.2 to 0.4 ug/l above background over the period January 19-25, 1986.

Detection at Kanawha River
(Ohio River mile 265.7)

There are nine large tributaries to the Ohio River between U.S. Steel and Cincinnati. The Kanawha River enters the Ohio River at mile 265.7 and is the only tributary equipped with a spill detection station. This station is equipped with a flame ionization detector, which has a minimum detection level of 5.0 ug/l. No benzene was measured at that sampling station, located 38.2 miles upstream from the confluence with the Ohio River.

Conclusion

Based on the foregoing calculations of time of travel and sampling data, the presence of benzene resulting from the December 28-29, 1985 spill at U.S. Steel was not detected at West View Water Authority -- a downstream distance of 23 miles. The extent to which the spill may have been detectable at the Wheeling site is not known as this site was not operable on or about the time the spill was estimated to have reached this downstream point. No benzene was detected at Huntington -- a downstream distance of 326.6 miles.

Data for the month of January from the Cincinnati Water Works ODS station indicated the presence of benzene on a continuous basis and often above expected background levels. However, it is highly unlikely that this could be attributed specifically to U.S. Steel because of the failure of West View Water Authority to detect the spill, the effects of dilution and volatilization and the potential for discharge of benzene from other NPDES permitted sources.

Other Sources of Benzene

Accounts in the Cincinnati news media concerning this spill event is yet another reminder of the public sensitivity to the presence of benzene in the Ohio River as well as the presence of

other toxic chemicals. Because benzene detected at the Cincinnati Water Works was most likely not attributable to U.S. Steel, the question remains as to other sources.

Based on a preliminary review of the Commission's NPDES permit file for Ohio River discharges, there are approximately 45 industrial facilities between U.S. Steel and the City of Cincinnati water intake permitted to discharge process wastewater which may contain some benzene (Attachment 3). Twelve of those facilities have NPDES permits with benzene limits and/or monitoring requirements. In addition, there are over 100 bulk terminals, storing petroleum products and various other chemicals, located within this stretch of the river. Without a complete inventory of each terminal, it cannot be determined which facilities have the potential to discharge benzene.

In addition to these point sources, benzene may be entering the Ohio River from tributary streams or from various non-point sources.

Time of Travel Calculations
 For December 28-29, 1985
 Spill at U.S. Steel Clairton Works

Time	Date	Mile Point	Location	Calculations
Noon	12/29	19.7 (Monongahela R.)	Clairton Steel 86.6 ug/l benzene	v = 0.63 mph on the Monongahela R. t = 24 hrs. d = 0.63 mph x 24 hrs. = 15.1 miles
Noon t = 24 hrs.	12/30	4.6 (Monongahela R.)		v = 0.58 mph on the Monongahela R. d = 19.7 - 15.1 = 4.6 miles t = 4.6 miles ÷ 0.58 mph = 7.93 hrs.
7:56 PM t = 31.9 hrs.	12/30	0.0 (Ohio R.)		v = 0.54 mph on the Ohio River d = 4.5 miles t = 4.5 miles ÷ 0.54 mph = 8.3 hrs.
4:14 AM t = 40.2 hrs.	12/31	4.5	West View	v = 0.54 mph t = 48 - 40.2 = 7.8 hrs. d = 7.8 hrs. x 0.54 mph = 4.21 miles
Noon t = 48 hrs.	12/31	8.7		v = 0.85 mph t = 24 hrs. d = 24 hrs. x 0.85 mph = 20.4 miles
Noon t = 72 hrs.	1/1	29.1		v = 0.47 mph t = 24 hrs. d = 24 hrs. x 0.47 mph = 11.2 miles
Noon t = 96 hrs.	1/2	40.2	East Liverpool	v = 0.7 mph t = 24 hrs. d = 24 hrs. x 0.7 mph = 16.8 miles
Noon t = 120 hrs.	1/3	57		v = 0.65 mph t = 24 hrs. d = 24 hrs. x 0.65 mph = 15.6 miles

Attachment 1 (continued)

Time of Travel Calculations
 For December 28-29, 1985
 Spill at U.S. Steel Clairton Works

Time	Date	Mile Point	Location	Calculations
Noon t = 144 hrs.	1/4	72.6		v = 0.62 mph d = 86.8 - 72.6 = 14.2 miles t = 14.2 miles ÷ 0.62 mph = 22.9 hrs.
10:50 AM t = 167 hrs.	1/5	86.8	Wheéling	v = 0.86 mph t = 168 - 167 = 1 hr. d = 1 hr. x 0.86 mph = 0.86 miles
Noon t = 168 hrs.	1/5	88		v = 0.83 mph t = 24 hrs. d = 24 hrs. x 0.83 mph = 19.9 miles
Noon t = 192 hrs.	1/6	108		v = 0.99 mph t = 24 hrs. d = 24 hrs. x 0.99 mph = 23.8 miles
Noon t = 216 hrs.	1/7	131.8		v = 0.91 mph t = 24 hrs. d = 24 hrs. x 0.91 mph = 21.8 miles
Noon t = 240 hrs.	1/8	153.6		v = 0.89 mph t = 24 hrs. d = 24 hrs. x 0.89 mph = 21.4 miles
Noon t = 264 hrs.	1/9	175		v = 0.89 mph d = 183 - 175 = 8 miles t = 8 miles ÷ 0.89 mph = 9 hrs.

Time of Travel Calculations
 For December 28-29, 1985
 Spill at U.S. Steel Clairton Works

Time	Date	Mile Point	Location	Calculations
9:00 PM t = 273 hrs.	1/9	183	Parkersburg	v = 0.62 mph t = 288 - 273 = 15 hrs. d = 15 hrs. x 0.62 mph = 9.3 miles
Noon t = 288 hrs.	1/10	192.3		v = 0.64 mph t = 24 hrs. d = 24 hrs. x 0.64 mph = 15.4 miles
Noon t = 312 hrs.	1/11	207.7		v = 0.65 mph t = 24 hrs. d = 24 hrs. x 0.65 mph = 15.6 miles
Noon t = 336 hrs.	1/12	223.3		v = 0.65 mph t = 24 hrs. d = 24 hrs. x 0.65 mph = 15.6 miles
Noon t = 360 hrs.	1/13	238.9		v = 0.57 mph t = 24 hrs. d = 24 hrs. x 0.57 mph = 13.7 miles
Noon t = 384 hrs.	1/14	252.6		v = 0.58 mph t = 24 hrs. d = 24 hrs. x 0.58 mph = 13.9 miles
Noon t = 408 hrs.	1/15	266.5		v = 0.62 mph t = 24 hrs. d = 24 hrs. x 0.62 mph = 14.9 miles
Noon t = 432 hrs.	1/16	281.4		v = 0.54 mph t = 24 hrs. d = 24 hrs. x 0.54 mph = 13 miles

Attachment 1 (continued)

Time of Travel Calculations
For December 28-29, 1985
Spill at U.S. Steel Clairton Works

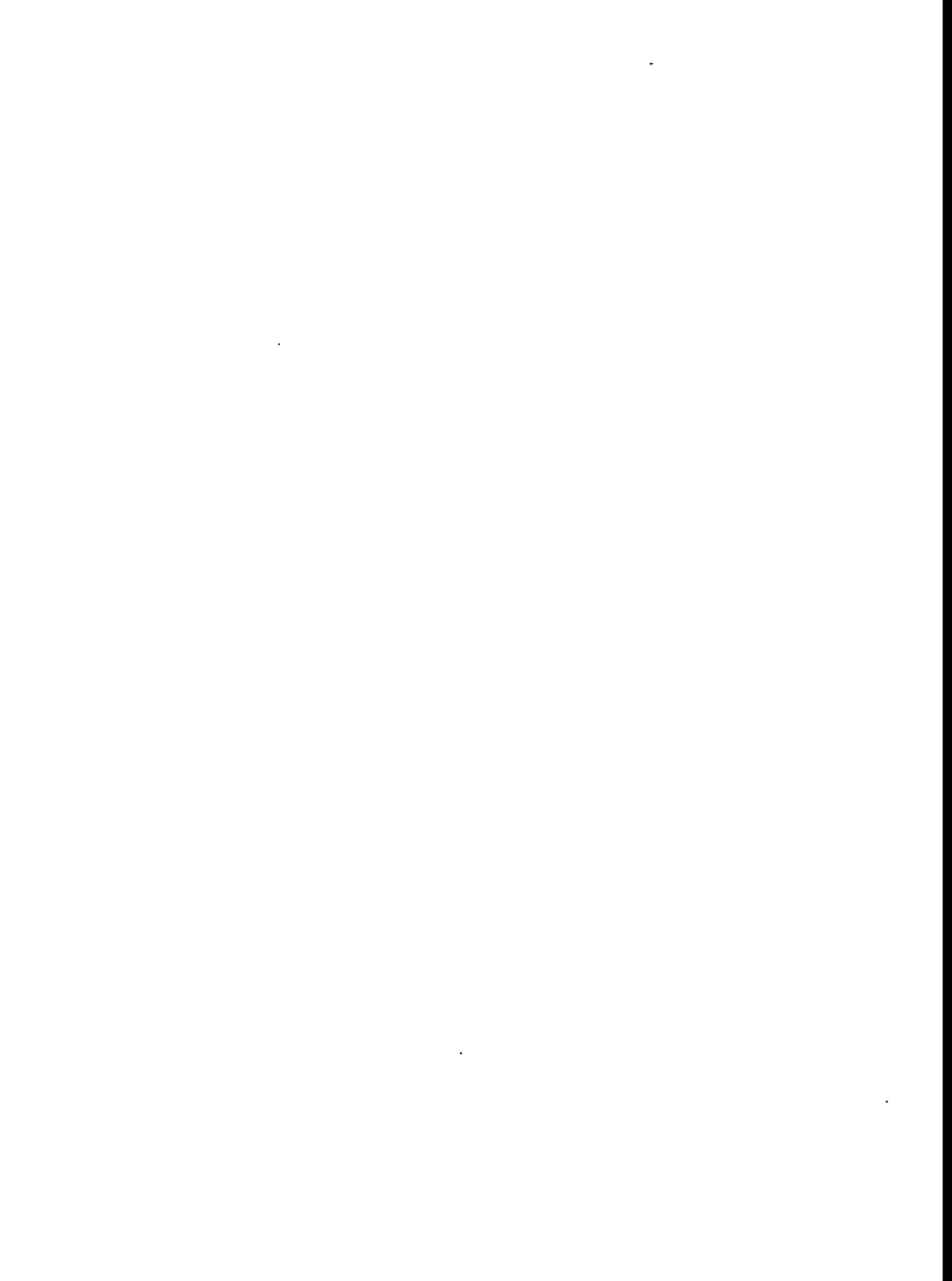
Time	Date	Mile Point	Location	Calculations
Noon t = 456 hrs.	1/17	294.4		v = 0.54 mph d = 306.9 - 294.4 = 12.5 miles t = 12.5 miles ÷ 0.54 mph = 23 hrs.
11:00 AM t = 479 hrs.	1/18	306.9	Huntington	v = 0.65 mph t = 480 - 479 = 1 hr. d = 1 hr. × 0.65 mph = 0.65 miles
Noon t = 480 hrs.	1/18	307.5		v = 0.63 mph t = 24 hrs. d = 24 hrs. × 0.63 mph = 15.1 miles
Noon t = 504 hrs.	1/19	322.6		v = 0.74 mph t = 24 hrs. d = 24 hrs. × 0.74 mph = 17.8 miles
Noon t = 528 hrs.	1/20	340.4		v = 0.86 mph d = 341 - 340.4 = 0.6 miles t = 0.6 miles ÷ 0.86 mph = 0.7 hrs.
12:45 PM t = 528.7 hrs.	1/20	341	Portsmouth	v = 0.86 mph t = 552 - 528.7 = 23.3 hrs. d = 23.3 hrs. × 0.86 mph = 20 miles
Noon t = 552 hrs.	1/21	361		v = 1.85 mph t = 24 hrs. d = 24 hrs. × 1.84 mph = 44.2 miles
Noon t = 576 hrs.	1/22	405.2		v = 2.46 mph d = 462 - 405.2 = 56.8 miles t = 56.8 miles ÷ 2.46 mph = 23 hrs.
11:00 AM t = 599 hrs.	1/23 25 days	462	Cincinnati	

Attachment 2

Benzene Concentration

<u>Date</u>	<u>Cincinnati Waterworks Ohio River</u>
Mon., 01/06/86	0.47 ug/l
Tue., 01/07/86	0.25 ug/l
Wed., 01/08/86	0.25 ug/l
Thu., 01/09/86	0.26 ug/l
Fri., 01/10/86	0.33 ug/l
Sat., 01/11/86	0.34 ug/l
Sun., 01/12/86	0.29 ug/l
Mon., 01/13/86	0.31 ug/l
Tue., 01/14/86	No data
Wed., 01/15/86	No data
Thu., 01/16/86	No data
Fri., 01/17/86	No data
Sat., 01/18/86	No data
Sun., 01/19/86	0.48 ug/l
Mon., 01/20/86	0.63 ug/l
Tue., 01/21/86	0.42 ug/l
Wed., 01/22/86	0.50 ug/l
Thu., 01/23/86	0.49 ug/l
Fri., 01/24/86	0.55 ug/l
Sat., 01/25/86	0.41 ug/l
Sun., 01/26/86	0
Mon., 01/27/86	<0.27 ug/l
Tue., 01/28/86	<0.27 ug/l
Wed., 01/29/86	No data
Thu., 01/30/86	<0.27 ug/l
Fri., 01/31/86	<0.27 ug/l

The minimum level of detection is approximately 0.25 ug/l.



Attachment 3

**Potential Benzene Dischargers
to the Ohio River
Between West View Water Authority and Cincinnati**

River Mile	Company	Product	
1	5.3	Calgon Corporation	Activated carbon
2	6.6	Neville Chemical Company	Resins, chlorinated paraffins, organic and inorganic chemicals
3	6.8	U.S. Steel-Neville Island	Steel
4	8.0	Shenango Coke & Iron*	Steel
5	14.6	Bethlehem Steel	Steel
6	15.9	Armco Steel	Steel
7	16.1	U.S. Steel Fabrication Plant	Metal fabrication
8	16.9	H.H. Robinson Co.**	Metal fabrication
9	17.0	Jones & Laughlin Steel*	Steel
10	23.9	Ampco-Pitts. Corp. **	Metal finisher
11	24.0	Ashland Petroleum-Freedom Refinery**	Oil and gas
12	29.7	ARCO Chemical Company	Polymers
13	36.3	Jones & Laughlin Steel**	Steel
14	42.4	Celotex Corp.	Roofing material
15	45.2	Quaker State Oil Refinery**	Oil
16	62.5	National Steel-Weirton	Steel
17	68.8	Wheeling Pittsburgh Steel	Steel
18	69.3	Koppers Co., Inc.*	Processing coke oven tar
19	69.7	Wheeling Steel	Steel
20	70.4	Wheeling Pittsburgh Steel	Steel
21	71.0	Wheeling Pittsburgh Steel	Steel
22	73.6	Genpak Corporation	Plastics manufacturer
23	79.4	Wheeling Pittsburgh Steel-Beach Bottom	Steel
24	81.8	Tri-State Asphalt Co.	Asphalt
25	83.7	Wheeling Pittsburgh Steel-Yorkville	Steel
26	88.8	Wheeling Pittsburgh Steel-Martins Ferry	Steel
27	89.0	Wheeling Pittsburgh Steel-Benwood	Steel
28	105.2	LCP Chemicals	Plastic
29	121.3	Mobay Chemical Corporation*	Organic chemicals
30	145.0	Union Carbide Corporation*	Silicone products

Attachment 3 (Cont.)

Potential Benzene Dischargers
to the Ohio River
Between West View Water Authority and Cincinnati

River Mile	Company	Product	
31	155.0	Quaker State**	Refinery
32	161.0	American Cyanamid	Organic chemicals
33	176.7	Elkem Metals Company**	Ferro alloy materials
34	178.0	Union Carbide Plastics**	Plastics
35	179.2	Chevron Asphalt Company	Asphalt products
36	187.0	Shell Chemical Company*	Chemical products
37	190.5	E.I. duPont deNemours	Plastic materials and synthetic resins
38	260.0	Pentasote Co. of N.Y.**	Polyvinyl chloride
39	270.0	Stauffer Chemical Company	Organic chemicals
40	281.0	Goodyear Tire & Rubber Company	Polyester resins
41	318.0	South Point Ethanol*	Fuel grade ethanol
42	324.6	Armco Steel	Steel
43	325.0	Allied Chemical*	Tar processing
44	332.0	E.I. duPont deNemours	Sulfuric acid
45	351.2	New Boston Coke*	Furnace coke

* Permit contains benzene limits and/or monitoring requirements.

**Permit contains some toxic organic limits and/or monitoring requirements.





